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(71)Applicant : MATSUSHITA ELECTRIC IND CO
LTD

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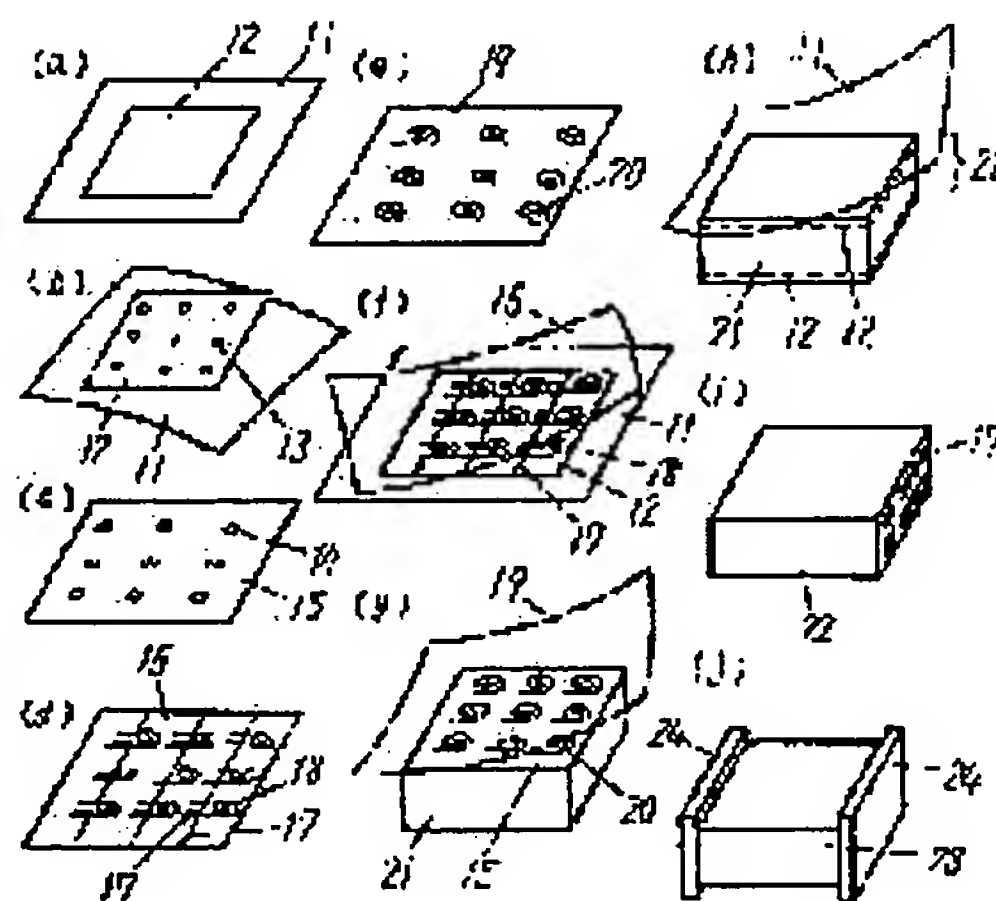
(72)Inventor : NAKAMORI TATSUYA
URYU HIDEKAZU
SOBANE MINORU
CHIBA HIRONOBU
OISHI KAZUO

(54) MANUFACTURING LAMINATED CHIP INDUCTOR

(57)Abstract:

PROBLEM TO BE SOLVED: To manufacture a laminated chip inductor with almost no crack at bonded faces.

SOLUTION: A first magnetic green sheet 12 and second magnetic green sheet filled with a conductive material 14 are formed, first conductors 18 having electroplated leading electrodes 17 and second conductors 20 are formed, the first and second conductors 18 and 20 are transferred to the first and 2nd magnetic green sheets 12 and 15, which are laminated to form an intermediate laminate 21 and it is cut into pieces 23 to form end face electrodes 24.



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(71) 出願人 000005821

松下電器産業株式会社

大阪府門真市大字門真1006番地

(72) 発明者 中森 達哉

大阪府門真市大字門真1006番地 松下電器産業株式会社内

(72) 発明者 瓜生 英一

大阪府門真市大字門真1006番地 松下電器産業株式会社内

(72) 発明者 曾羽 実

大阪府門真市大字門真1006番地 松下電器産業株式会社内

(74) 代理人 弁理士 滝本 智之 (外1名)

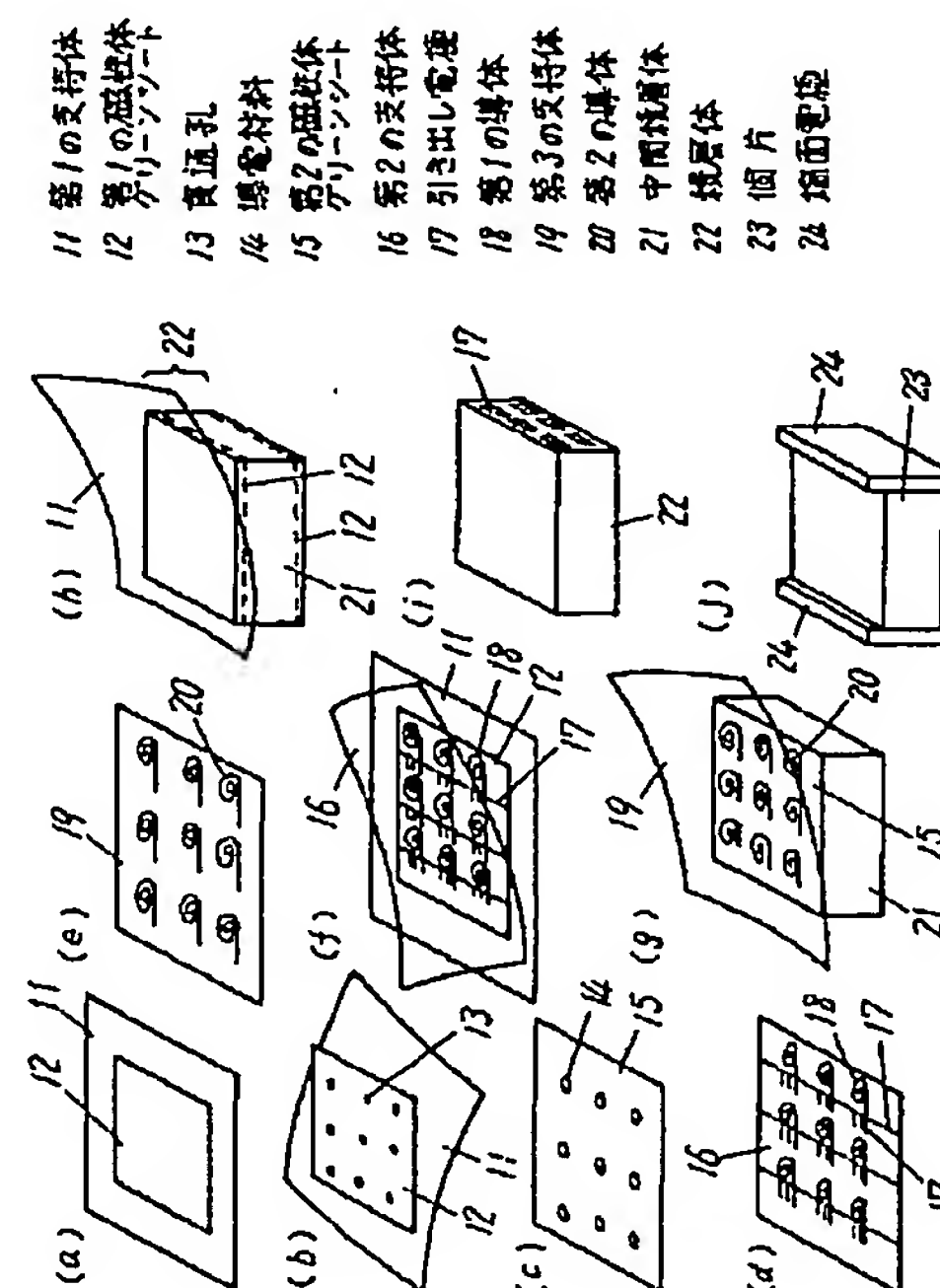
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(54) 【発明の名称】 積層チップインダクタの製造方法

(57) 【要約】

【課題】 接合面にクラックが発生しにくい積層チップインダクタの製造方法を提供することを目的とする。

【解決手段】 第1の磁性体グリーンシート12を形成し、導電材料14が充填された第2の磁性体グリーンシート15を形成し、電気めっきより引き出し電極17を有する第1の導体18および第2の導体20を形成し、第1の磁性体グリーンシート12に第1の導体18を転写し、第2の磁性体グリーンシート15に第2の導体20を転写・積層して形成された中間積層体21の上・下面に転写し、個片23に切断し焼成して端面電極24を形成するものである。



【特許請求の範囲】

【請求項1】 第1の支持体の上面に磁性体スラリーをシート状に塗布・乾燥して第1の磁性体グリーンシートを形成する第1のシート形成工程と、

前記第1の支持体を剥離した後前記第1の磁性体グリーンシートに複数の貫通孔を形成しこの貫通孔に導電材料を充填して第2の磁性体グリーンシートを形成する第2のシート形成工程と、

第2の支持体の上面に電気めっきにより複数本の引き出し電極を有するコイル状の第1の導体を複数個形成する第1のめっき工程と、

第3の支持体の上面に電気めっきによりコイル状の第2の導体を複数個形成する第2のめっき工程と、

前記第1のシート形成工程で得られた第1の磁性体グリーンシートの上面に前記第1の導体を熱圧着により転写して第2の支持体を剥離する転写工程と、

前記第2のシート形成工程で得られた第2の磁性体グリーンシートの上面に前記第2の導体を前記第2の磁性体グリーンシートに充填された導電材料を介して電氣的に接続するように熱圧着により転写し第3の支持体を剥離・積層を繰り返して中間積層体を形成する中間積層体形成工程と、

前記中間積層体の上面と下面とに前記第1の導体を転写した第1の磁性体グリーンシートを導電材料を介して電氣的に接続するように熱圧着により転写し前記第1の支持体を剥離して積層体を形成する積層体形成工程と、
前記積層体形成工程で得られた積層体を前記引き出し電極を切断するように個片に切断し焼成する個片形成工程と、

前記個片形成工程で焼成された前記個片の対向する端面に前記引き出し電極と電氣的に接続するように端面電極を形成する電極形成工程とからなる積層チップインダクタの製造方法。

【請求項2】 引き出し電極は、隣接する少なくとも2方向で切断されるように形成する請求項1記載の積層チップインダクタの製造方法。

【請求項3】 引き出し電極は、端面電極との接続部で幅が異なるように形成する請求項1記載の積層チップインダクタの製造方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、小型デジタル電子機器の高密度実装回路基板に用いられ、電子回路の直流電源ラインに発生するノイズを抑制する積層チップインダクタの製造方法に関するものである。

【0002】

【従来の技術】近年、積層チップインダクタは、デジタル機器の小型・薄形化に伴う高密度実装回路基板からのノイズを抑制するノイズ対策部品として用途が拡大されている。

【0003】以下、従来の積層チップインダクタについて説明する。従来の積層チップインダクタは、実願昭59-162031号（実開昭61-76928号）のマイクロフィルムに、コ字状の導体パターンを上面に有するセラミックシートが複数枚積層されてなる磁性体層と、各磁性体層の導体パターンを電氣的に接続するスルーホールと、このスルーホールの周縁に設けられた補強用導体パターンと、この磁性体層の上・下面のそれぞれに設けられた磁性体層とで一体積層物をなし、この一体積層物の対向する両端面に端面電極を設けたものが開示されている。

【0004】以下、従来の積層チップインダクタについて、図面を参照しながら説明する。図4は従来の積層チップインダクタの一部を分解した分解斜視図、図5は同斜視図である。

【0005】図において、1は磁性材料からなる磁性体グリーンシートである。2は磁性体グリーンシート1の上面に銀パラジウム等の導電材料をコ字状に印刷して形成された導体パターンで、コ字状の一端に幅を広くした引き出し電極3が設けられている。4は磁性体グリーンシート1の上面に銀パラジウム等の導電材料をコ字状に印刷して形成された金属よりなる導体パターンである。

【0006】このような従来のチップインダクタは、まず上面に導体パターン4が設けられた磁性体グリーンシート1を複数枚積層し、その上・下面に導体パターン2が設けられた磁性体グリーンシート1を積層して中間積層体5を形成し、次に中間積層体5の上・下面に磁性体グリーンシート1を積層したものを熱圧着・焼成して一体形成し、対向する端面に導体パターンと電氣的に接続するように銀等の金属ペーストで端面電極6を塗布して製造していた。

【0007】

【発明が解決しようとする課題】しかしながら、上記従来のものでは、磁性体グリーンシート1の間に導体パターン4を挟み込んで積層・焼成する際、導体パターンの金属と磁性体グリーンシートとの収縮率が異なるため、接合面からクラックが発生するという課題を有するものである。

【0008】上記課題を解決するために本発明は、磁性体グリーンシートと金属の導体とを積層しても接合面にクラックが発生しにくい積層チップインダクタの製造方法を提供することを目的とするものである。

【0009】

【課題を解決するための手段】上記目的を達成するために本発明は、第2の支持体の上面に電気めっきにより複数本の引き出し電極を有するコイル状の第1の導体を複数個形成する工程とを有するものである。

【0010】

【発明の実施の形態】本発明の請求項1に記載の発明は、第1の支持体の上面に磁性体スラリーをシート状に

塗布・乾燥して第1の磁性体グリーンシートを形成する第1のシート形成工程と、前記第1の支持体を剥離した後前記第1の磁性体グリーンシートに複数個の貫通孔を形成しこの貫通孔に導電材料を充填して第2の磁性体グリーンシートを形成する第2のシート形成工程と、第2の支持体の上面に電気めっきにより複数本の引き出し電極を有するコイル状の第1の導体を複数個形成する第1のめっき工程と、第3の支持体の上面に電気めっきによりコイル状の第2の導体を複数個形成する第2のめっき工程と、前記第1のシート形成工程で得られた第1の磁性体グリーンシートの上面に前記第1の導体を熱圧着により転写して第2の支持体を剥離する転写工程と、前記第2のシート形成工程で得られた第2の磁性体グリーンシートの上面に前記第2の導体を前記第2の磁性体グリーンシートに充填された導電材料を介して電氣的に接続するように熱圧着により転写し第3の支持体を剥離・積層を繰り返して中間積層体を形成する中間積層体形成工程と、前記中間積層体の上面と下面とに前記第1の導体を転写した第1の磁性体グリーンシートを導電材料を介して電氣的に接続するように熱圧着により転写し前記第1の支持体を剥離して積層体を形成する積層体形成工程と、前記積層体形成工程で得られた積層体を前記引き出し電極を切断するように個片に切断し焼成する個片形成工程と、前記個片形成工程で焼成された前記個片の対向する端面に前記引き出し電極と電氣的に接続するように端面電極を形成する電極形成工程とを有するものである。

【0011】また、請求項2に記載の発明は、請求項1の発明の引き出し電極は、隣接する少なくとも2方向で切断されるように形成するものである。

【0012】また、請求項3に記載の発明は、請求項1の発明の引き出し電極は、端面電極との接続部で幅が異なるように形成するものである。

【0013】上述した請求項により、積層時に磁性体グリーンシートと導体との接合面にクラックが発生しにくく、かつ端面電極と導体との接続が向上するという作用を有するものである。

【0014】以下、本発明の一実施の形態における積層チップインダクタの製造方法について、図面を参照しながら説明する。

【0015】図1は本発明の一実施の形態における積層チップインダクタの製造方法を示す工程図である。

【0016】まず、図1(a)に示すように、ブチラール等の樹脂と酢酸ブチル等の溶剤と可塑剤とを溶解させたビヒクルと、Ni・Zn・Cu系のフェライト粉末とを混練してなる磁性体スラリーを第1の支持体11の上面にドクターブレード法でシート状に塗布し、約70℃で乾燥して第1の磁性体グリーンシート12を形成する。

【0017】次に、図1(b)に示すように、第1の支

持体11を剥離した第1の磁性体グリーンシート12にパンチング等により直径0.1~0.2mm程度の貫通孔13を形成する。

【0018】次に、図1(c)に示すように、貫通孔13に銀または銀パラジウム等の導電材料14を充填して第2の磁性体グリーンシート15を形成する。

【0019】次に、図1(d)に示すように、第2の支持体16の上面にフォトリソストを塗布し、引き出し電極17を有するコイル状の第1の導体18を形成するパターンに露光・現像してレジストを剥離し、第2の支持体16の上面に引き出し電極17のパターンとコイル状のパターンとを露出させる。この露出させたパターンの上面に電気めっきを3A/dm²で約20分間行い、導電性の高い銀等の金属を着膜して引き出し電極17を有する第1の導体18を形成する。ここでコイル状の第1の導体18の幅は約45μmで約2ターン、膜厚は約20μmであり、引き出し電極17の幅は約55μmで先端が三方向に引き延ばされる構造とした。また、この電気めっきではめっき浴としてノーシアン銀めっき浴（大和化成株式会社製、AG-PL30酸性浴）を用いた。

【0020】次に、図1(e)に示すように、第3の支持体19の上面にフォトリソストを塗布し、第2の導体20を形成するコイル状のパターンに露光・現像してレジストを剥離し、第3の支持体19の上面にコイル状のパターンを露出させる。この露出させた第3の支持体19のコイル状のパターンの上面に前工程と同様に電気めっきを行い第2の導体20を形成する。

【0021】次に、図1(f)に示すように、第1の磁性体グリーンシート12の上面に第1の導体18を約60~120℃で熱圧着して転写し、第2の支持体16を剥離する。

【0022】次に、図1(g)に示すように、第2の磁性体グリーンシート15の上面に第2の導体20を第2の磁性体グリーンシート15に充填された導電材料14を介して電氣的に接続するように位置合わせをし、約60~120℃で熱圧着して転写し、第3の支持体19を剥離する。この転写を繰り返し積層して中間積層体21を形成する。

【0023】次に、図1(h)に示すように、中間積層体21の上面と下面とに第1の導体18を転写した第1の磁性体グリーンシート12を導電材料14を介して電氣的に接続するように位置合わせをし、約60~120℃で熱圧着して転写し、第1の支持体11を剥離して積層体22を形成する。

【0024】次に、図1(i)に示すように、積層体22の内部に形成されている引き出し電極17が隣接する第1の導体18との間で二分されるようにダミー部分を残して縦横の切断位置を定め、積層体22を所定サイズの個片23に切断する。この切断位置を図2に示す。引き出し電極17を、隣接する第1の導体18と一方向の

みで二分されるようにダミー部分25を残して切断するものである。この後、約900℃で約1時間焼成する。

【0025】次に、図1(j)に示すように、前工程で焼成した個片23の対向する端面に引き出し電極17と電氣的に接続するように銀等の金属ペーストを塗布し、約850℃で焼成して端面電極24を形成する。

【0026】最後に、必要に応じて端面電極24を覆うようにニッケルめっき、はんだめっき等を施して積層チップインダクタを製造するものである。

【0027】このように、積層体22を個片23に切断する際、ダミー部分25を有するため、切断位置や中間積層体21の積層時の位置ずれが生じても、引き出し電極17と端面電極24とが十分に接続されるものである。

【0028】また、図3に示すように、引き出し電極26が、隣接する第1の導体27と少なくとも二方向へ引き延ばされ、ダミー部分28が二方向以上に形成されると、引き出し電極26が端面電極24と接する接続部が二面以上となり、より強固に接続されるものである。

【0029】また、引き出し電極17と端面電極24とが接する接続部が一面であれば、引き出し電極17の幅を広く取らなければ電氣的に十分な接続が得られない *

*が、引き出し電極17が二面以上で接続されているため、幅を広く取る必要がなく端面電極24との接続部で引き出し電極17の幅を狭くする等、幅が異なるように形成してもよい。

【0030】ここで、本発明の一実施の形態における積層チップインダクタを、引き出し電極の本数と幅とを変えて試作し、電氣的接続率と端面クラックの発生率を比較する。

【0031】本発明の一実施の形態における積層チップインダクタを、膜厚を一定にし、引き出し電極の本数が一方向から四方向に引き延ばされる構造で、引き出し電極幅を20～100μmにしたものを各200個ずつ試作した。このとき、コイル状の第1の導体より0.5Ωの抵抗値が得られるように設計し、本発明の一実施の形態における積層チップインダクタの抵抗値が0.7Ω以下のものは断線せず、電氣的接続がされているものである。この試作品全数に対し電氣的接続されている割合（電氣的接続率）と端面クラックの発生率を比較したものを（表1）に示す。

【0032】

【表1】

サンプル 番号	引き出し 電極幅 (μm)	引き出し 本数 (本)	膜厚 (μm)	導体 断面積 (μm ²)	電氣的 接続率 (%)	端面クラック の発生率 (%)
1	100	3	20	6000	100	0
2	100	1	20	2000	99	0
3	50	3	20	3000	100	0
4	20	4	20	1600	100	0
5	20	3	20	1200	100	0
6	20	2	20	800	93	0
7	20	1	20	400	89	0

【0033】（表1）より、引き出し電極幅が20μmと狭い場合は、引き出し本数を増やすほど導体断面積が増し、電氣的接続率が高まることがわかる。引き出し本数が3本の場合、電氣的接続率は導体断面積が約1200μm²になると十分な接続が得られる。また、引き出し電極幅が100μmと広い場合は、引き出し本数が1本でも十分な電氣的接続率が得られるものである。

【0034】なお、上述した製造方法では、第2の磁性体グリーンシート15と第2の導体20とをあらかじめ複数回積層し、中間積層体21としてさらに第1の導体18を転写した第1の磁性体グリーンシート12を転写・積層したが、中間積層体21を形成せずに第1の磁性体グリーンシート12の上面に順次転写・圧着してもよい。

【0035】

【発明の効果】以上のように本発明は、磁性体グリーンシートと金属の導体とを積層しても接合面にクラックが

発生しにくく、かつ端面電極と導体との電氣的な接続が向上する積層チップインダクタの製造方法を提供することができるものである。

【図面の簡単な説明】

【図1】本発明の一実施の形態における積層チップインダクタの製造方法を示す工程図

【図2】同要部である引き出し電極と積層体との切断位置を示す図

【図3】同要部である他の引き出し電極と積層体との切断位置を示す図

【図4】従来のチップ形インダクタの構造を示す分解斜視図

【図5】同斜視図

【符号の説明】

11 第1の支持体

12 第1の磁性体グリーンシート

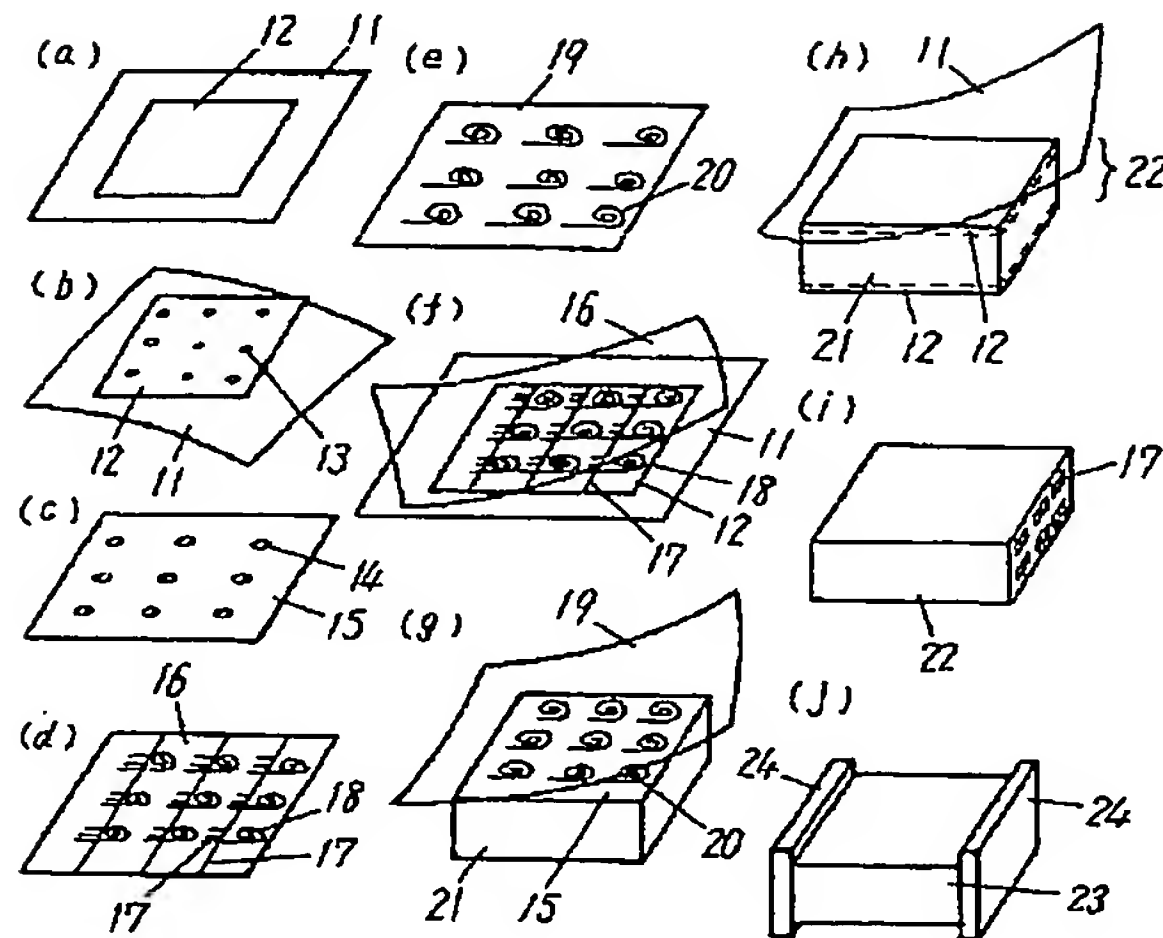
13 貫通孔

- 14 導電材料
15 第2の磁性体グリーンシート
16 第2の支持体
17 引き出し電極
18 第1の導体
19 第3の支持体

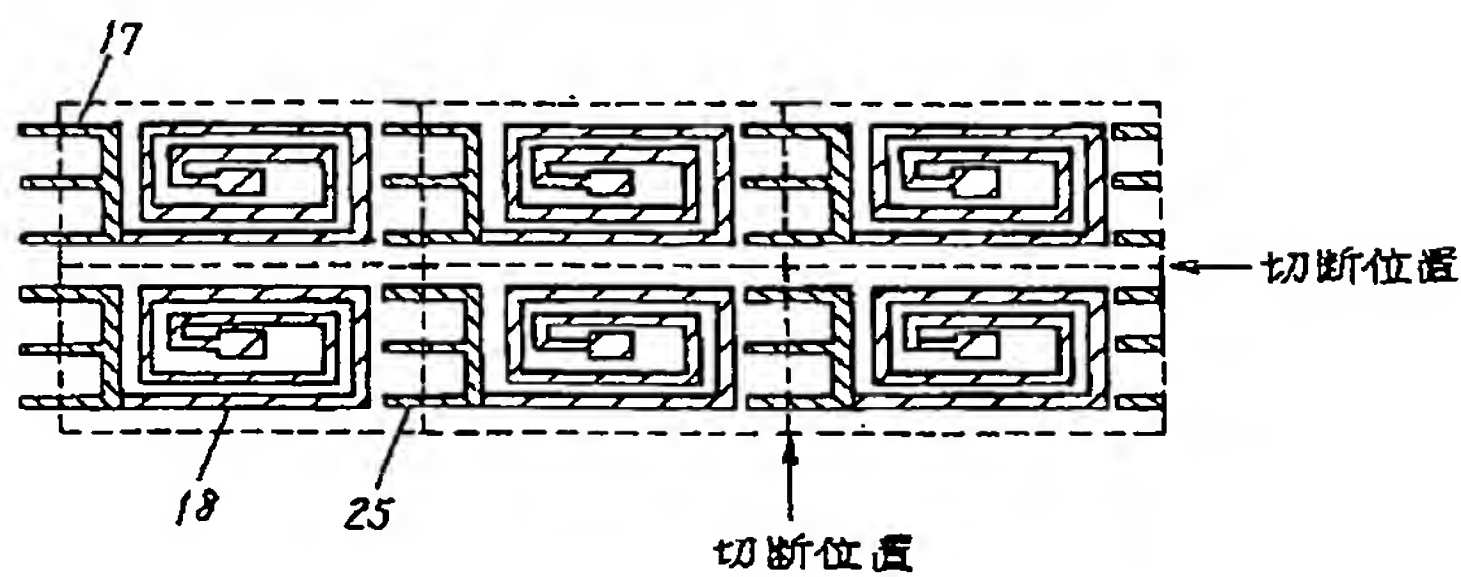
- * 20 第2の導体
21 中間積層体
22 積層体
23 個片
24 端面電極

*

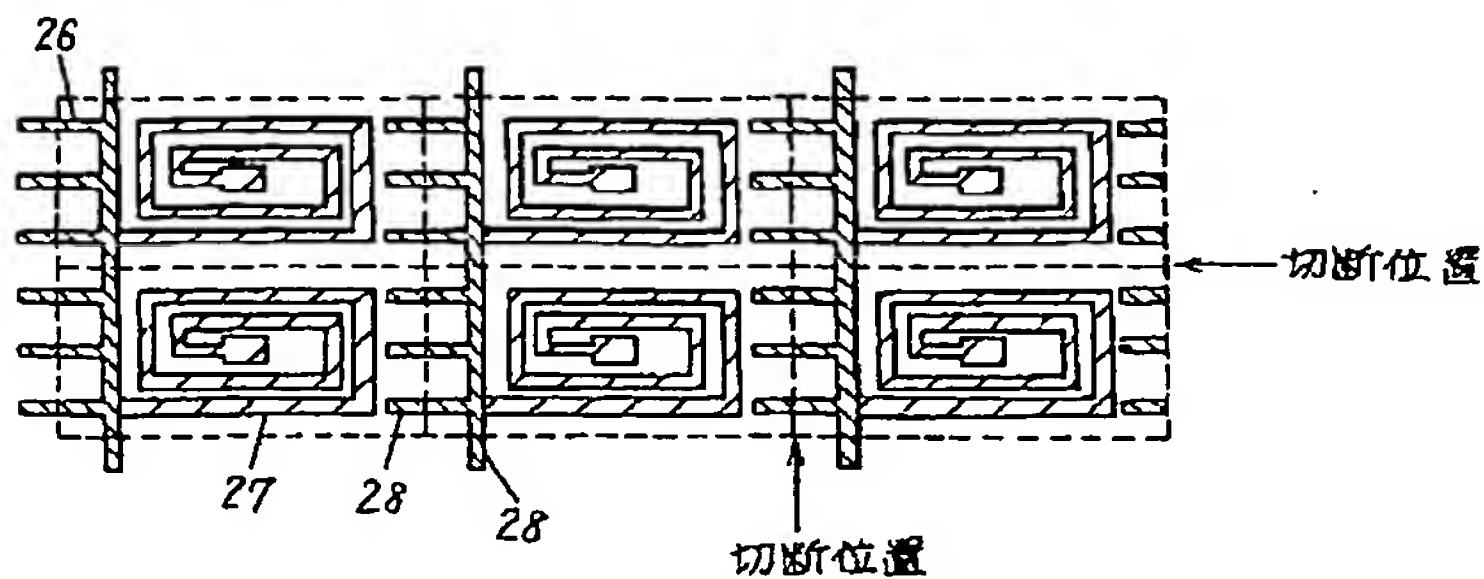
【図1】



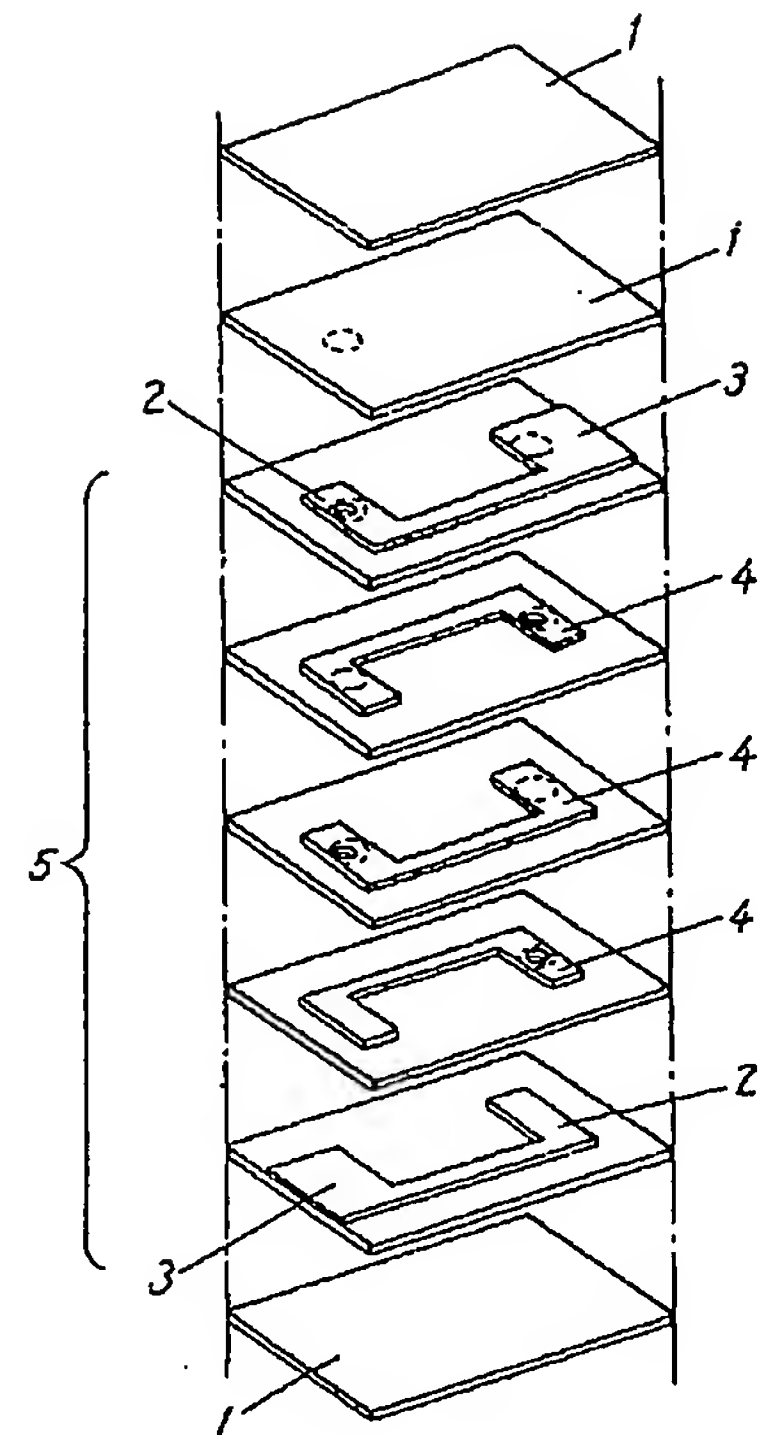
【図2】



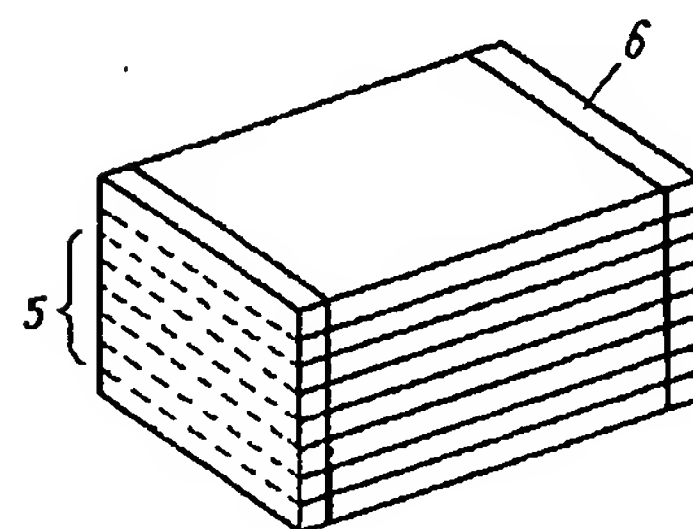
【図3】



【図4】



【図5】



フロントページの続き

(72)発明者 千葉 博伸
大阪府門真市大字門真1006番地 松下電器
産業株式会社内

(72)発明者 大石 一夫
大阪府門真市大字門真1006番地 松下電器
産業株式会社内

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CLAIMS

[Claim(s)]

[Claim 1] The 1st sheet formation process which applies and dries a magnetic-substance slurry in the shape of a sheet, and forms the 1st magnetic-substance green sheet in the top face of the 1st base material, The 2nd sheet formation process which forms two or more through tubes in the magnetic-substance green sheet of the account 1st of back to front which exfoliated said 1st base material, fills up this through tube with an electrical conducting material, and forms the 2nd magnetic-substance green sheet, The 1st plating process which forms in the top face of the 2nd base material two or more 1st coiled form conductor which has two or more drawer electrodes by electroplating, The 2nd plating process which forms two or more 2nd coiled form conductor in the top face of the 3rd base material by electroplating, The imprint process which imprints said 1st conductor by thermocompression bonding on the top face of the 1st magnetic-substance green sheet obtained with said 1st sheet formation process, and exfoliates the 2nd base material, So that it may connect with the top face of the 2nd magnetic-substance green sheet obtained with said 2nd sheet formation process electrically through the electrical conducting material filled up with said 2nd conductor by said 2nd magnetic-substance green sheet The middle layered product formation process which imprints by thermocompression bonding, repeats exfoliation and a laminating for the 3rd base material, and forms a middle layered product, The layered product formation process which imprints by thermocompression bonding, exfoliates said 1st base material, and forms a layered product so that the 1st magnetic-substance green sheet which imprinted said 1st conductor may be electrically connected to the top face and inferior surface of tongue of said middle layered product through an electrical conducting material, The piece formation process of an individual which cuts and calcinates the layered product obtained with said layered product formation process to the piece of an

individual so that said drawer electrode may be disconnected, The manufacture approach of a laminating chip inductor which consists of an electrode formation process which forms an end-face electrode so that it may connect with said drawer electrode electrically at the end face which said piece of an individual calcinated with said piece formation process of an individual counters.

[Claim 2] A drawer electrode is the manufacture approach of the adjoining laminating chip inductor according to claim 1 formed so that it may be cut by the 2-way at least.

[Claim 3] A drawer electrode is the manufacture approach of the laminating chip inductor according to claim 1 formed so that width of face may differ by the connection with an end-face electrode.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention is used for the high-density-assembly circuit board of small digital electronic equipment, and relates to the manufacture approach of the laminating chip inductor which controls the noise generated in DC-power-supply Rhine of an electronic circuitry.

[0002]

[Description of the Prior Art] In recent years, the application is expanded as noise cure components with which a laminating chip inductor controls the noise from the high-density-assembly circuit board accompanying small and the formation of a thin form of a digital instrument.

[0003] Hereafter, the conventional laminating chip inductor is explained.

The magnetic layer to which it comes to carry out two or more sheet laminating of the ceramic sheet with which the conventional laminating chip inductor has a KO character-like conductor pattern on the top face on the microfilm of an application for utility model registration No. (JP, 61-76928, U) 162031 [Showa 59 to], The through hole which connects the conductor pattern of each magnetic layer electrically, and the conductor pattern for reinforcement prepared in the periphery of this through hole, what really prepared the end-face electrode in the both-ends side where laminated material nothing and really [this] counters laminated material by the magnetic layer which this magnetic layer top and the inferior surface of tongue were alike, respectively, and was prepared is indicated.

[0004] Hereafter, the conventional laminating chip inductor is explained, referring to a drawing. The decomposition perspective view and drawing 5 into which drawing 4 decomposed a part of conventional laminating chip inductor are this perspective view.

[0005] In drawing, 1 is a magnetic-substance green sheet which consists of a magnetic material. 2 is the conductor pattern which printed electrical conducting materials, such as silver palladium, on the top face of the magnetic-substance green sheet 1 in the shape of a KO character, and was formed in it, and the drawer electrode 3 which made width of face large is formed in the KO character-like end. 4 is a conductor pattern which consists of a metal which printed electrical conducting materials, such as silver palladium, on the top face of the magnetic-substance green sheet 1 in the shape of a KO character, and was formed in it.

[0006] Such a conventional chip inductor carries out two or more sheet laminating of the magnetic-substance green sheet 1 with which the conductor pattern 4 was first formed in the top face. Carry out the laminating of the magnetic-substance green sheet 1 with which the conductor pattern 2 was moreover formed in - inferior surface of tongue, and the middle layered product 5 is formed. Next, the end-face electrode 6 was applied and manufactured with metal pastes, such as silver, so that it might calcinate, it might really form and what carried out the laminating of the magnetic-substance green sheet 1 to the middle layered product 5 top and the inferior surface of tongue might be electrically connected with a conductor pattern at thermocompression bonding and the end face which counters.

[0007]

[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional thing, since a conductor pattern 4 is put between

the magnetic-substance green sheets 1, and contraction of the metal of a conductor pattern and a magnetic-substance green sheet differs in case it calcinates, a laminating and, it has the technical problem that a crack occurs from a plane of composition.

[0008] In order to solve the above-mentioned technical problem, even if this invention carries out the laminating of a magnetic-substance green sheet and the metaled conductor, it aims at offering the manufacture approach of the laminating chip inductor which a crack cannot generate easily in a plane of composition.

[0009]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, this invention has the process which forms in the top face of the 2nd base material two or more 1st coiled form conductor which has two or more drawer electrodes by electroplating.

[0010]

[Embodiment of the Invention] The 1st sheet formation process with which invention of this invention according to claim 1 applies and dries a magnetic-substance slurry in the shape of a sheet, and forms the 1st magnetic-substance green sheet in the top face of the 1st base material, The 2nd sheet formation process which forms two or more through tubes in the magnetic-substance green sheet of the account 1st of back to front which exfoliated said 1st base material, fills up this through tube with an electrical conducting material, and forms the 2nd magnetic-substance green sheet, The 1st plating process which forms in the top face of the 2nd base material two or more 1st coiled form conductor which has two or more drawer electrodes by electroplating, The 2nd plating process which forms two or more 2nd coiled form conductor in the top face of the 3rd base material by electroplating, The imprint process which imprints said 1st conductor by thermocompression bonding on the top face of the 1st magnetic-substance green sheet obtained with said 1st sheet formation process, and exfoliates the 2nd base material, So that it may connect with the top face of the 2nd magnetic-substance green sheet obtained with said 2nd sheet formation process electrically through the electrical conducting material filled up with said 2nd conductor by said 2nd magnetic-substance green sheet The middle layered product formation process which imprints by thermocompression bonding, repeats exfoliation and a laminating for the 3rd base material, and forms a middle layered product, The layered product formation process which imprints by thermocompression bonding, exfoliates said 1st base material, and forms a layered product so that the 1st magnetic-substance green sheet which imprinted said 1st conductor may be electrically connected to the top

face and inferior surface of tongue of said middle layered product through an electrical conducting material, The piece formation process of an individual which cuts and calcinates the layered product obtained with said layered product formation process to the piece of an individual so that said drawer electrode may be disconnected, It has the electrode formation process which forms an end-face electrode so that it may connect with said drawer electrode electrically at the end face which said piece of an individual calcinated with said piece formation process of an individual counters.

[0011] Moreover, invention according to claim 2 is a thing which the drawer electrode of invention of claim 1 adjoins and which is formed so that it may be cut by the 2-way at least.

[0012] Moreover, the drawer electrode of invention of claim 1 forms invention according to claim 3 so that width of face may differ by the connection with an end-face electrode.

[0013] It has an operation that are hard to generate a crack in the plane of composition of a magnetic-substance green sheet and a conductor at the time of a laminating, and connection between an end-face electrode and a conductor improves by the claim mentioned above.

[0014] Hereafter, the manufacture approach of the laminating chip inductor in the gestalt of 1 operation of this invention is explained, referring to a drawing.

[0015] Drawing 1 is process drawing showing the manufacture approach of the laminating chip inductor in the gestalt of 1 operation of this invention.

[0016] First, as shown in drawing 1 (a), the magnetic-substance slurry which comes to knead the vehicle in which resin, solvents, such as butyl acetate, and plasticizers, such as butyral, were dissolved, and the ferrite powder of a nickel-Zn-Cu system is applied to the top face of the 1st base material 11 in the shape of a sheet with a doctor blade method, it dries at about 70 degrees C, and the 1st magnetic-substance green sheet 12 is formed.

[0017] Next, as shown in drawing 1 (b), the through tube 13 with a diameter of about 0.1-0.2mm is formed in the 1st magnetic-substance green sheet 12 which exfoliated the 1st base material 11 by punching etc.

[0018] Next, as shown in drawing 1 (c), a through tube 13 is filled up with the electrical conducting materials 14, such as silver or silver palladium, and the 2nd magnetic-substance green sheet 15 is formed.

[0019] Next, as shown in drawing 1 (d), a photoresist is applied to the top face of the 2nd base material 16, negatives are exposed and developed, and it exfoliates, a resist is pulled out on the top face of

the 2nd base material 16, and the pattern of an electrode 17 and a coiled form pattern are exposed to the pattern which forms the 1st coiled form conductor 18 which has the drawer electrode 17.

Electroplating is performed on the top face of this exposed pattern for about 20 minutes by 3 A/dm², and the 1st conductor 18 which carries out film deposition of the metals, such as conductive high silver, pulls them out, and has an electrode 17 is formed. In about 45 micrometers, the width of face of the 1st conductor 18 of a coiled form [here] is about 2 turns, thickness is about 20 micrometers, and width of face of the drawer electrode 17 was made into the structure where a tip is extended by the three way by about 55 micrometers. Moreover, in this electroplating, the no silver cyanide plating bath (Yamato formation incorporated company make, an AG-PL30 acidity bath) was used as a plating bath.

[0020] Next, a photoresist is applied to the top face of the 3rd base material 19, negatives are exposed and developed, a resist is exfoliated to the coiled form pattern which forms the 2nd conductor 20, and the top face of the 3rd base material 19 is made to expose a coiled form pattern to it, as shown in drawing 1 (e). Electroplating is performed on the top face of the coiled form pattern of this 3rd exposed base material 19 like a last process, and the 2nd conductor 20 is formed in it.

[0021] Next, as shown in drawing 1 (f), at about 60-120 degrees C, thermocompression bonding of the 1st conductor 18 is carried out to the top face of the 1st magnetic-substance green sheet 12, it is imprinted on it, and the 2nd base material 16 is exfoliated.

[0022] Next, as shown in drawing 1 (g), alignment is carried out so that it may connect with the top face of the 2nd magnetic-substance green sheet 15 electrically through the electrical conducting material 14 filled up with the 2nd conductor 20 by the 2nd magnetic-substance green sheet 15, and at about 60-120 degrees C, thermocompression bonding is carried out, it imprints, and the 3rd base material 19 is exfoliated. The laminating of this imprint is repeated and carried out, and the middle layered product 21 is formed.

[0023] Next, as shown in drawing 1 (h), alignment is carried out so that the 1st magnetic-substance green sheet 12 which imprinted the 1st conductor 18 may be electrically connected to the top face and inferior surface of tongue of the middle layered product 21 through an electrical conducting material 14, and at about 60-120 degrees C, thermocompression bonding is carried out, it imprints, the 1st base material 11 is exfoliated, and a layered product 22 is formed.

[0024] Next, as shown in drawing 1 (i), it leaves a dummy part, a

cutting location in every direction is defined so that it may be divided into two between the 1st conductor 18 with which the drawer electrode 17 currently formed in the interior of a layered product 22 adjoins, and a layered product 22 is cut to the piece 23 of an individual of predetermined size. This cutting location is shown in drawing 2 . It leaves the dummy part 25 and the drawer electrode 17 is disconnected so that it may be divided into two only in the 1st adjoining conductor 18 and adjoining one direction. Then, it calcinates at about 900 degrees C for about 1 hour.

[0025] Next, as shown in drawing 1 (j), metal pastes, such as silver, are applied so that it may pull out to the end face which the piece 23 of an individual calcinated at the last process counters and may connect with an electrode 17 electrically, and it calcinates at about 850 degrees C, and the end-face electrode 24 is formed.

[0026] Finally, nickel plating, solder plating, etc. are performed and a laminating chip inductor is manufactured so that the end-face electrode 24 may be covered if needed.

[0027] Thus, even if the location gap at the time of a cutting location or the laminating of the middle layered product 21 arises since it has the dummy part 25 in case a layered product 22 is cut to the piece 23 of an individual, the drawer electrode 17 and the end-face electrode 24 are fully connected.

[0028] Moreover, if the drawer electrode 26 is extended in the 1st adjoining conductor 27 and at least 2 adjoining directions and the dummy part 28 is formed in the two or more directions as shown in drawing 3 , the connection to which the drawer electrode 26 touches the end-face electrode 24 will become the second [or more] page, and will be connected more firmly.

[0029] Moreover, if the connection which the drawer electrode 17 and the end-face electrode 24 touch is the whole surface, and large width of face of the drawer electrode 17 is not taken, sufficient connection will not be obtained electrically, but since the drawer electrode 17 is connected by the second [or more] page, you may form it not being necessary to take large width of face, pulling out by the connection with the end-face electrode 24, and narrowing width of face of an electrode 17 etc. so that width of face may differ.

[0030] The number and width of face of a drawer electrode are changed, the laminating chip inductor in the gestalt of 1 operation of this invention is made as an experiment here, and the rate of electrical installation is compared with the incidence rate of an end-face crack.

[0031] Every 200 things each which set drawer electrode width of face to

20-100 micrometers were made as an experiment with the structure where fix thickness and the number of a drawer electrode is extended in the four directions from an one direction in the laminating chip inductor in the gestalt of 1 operation of this invention. At this time, it designs so that the resistance of 0.5 ohms may be acquired from the 1st coiled form conductor, and the resistance of the laminating chip inductor in the gestalt of 1 operation of this invention does not disconnect a thing 0.7ohms or less, but electrical installation is carried out. What compared the incidence rate of the rate (rate of electrical installation) by which electrical installation is carried out to this prototype total, and an end-face crack is shown in (Table 1).

[0032]

[Table 1]

サンプル 番号	引き出し 電極幅 (μm)	引き出し 本数 (本)	膜厚 (μm)	導体 断面積 (μm^2)	電氣的 接続率 (%)	端面クラック の発生率 (%)
1	100	3	20	6000	100	0
2	100	1	20	2000	99	0
3	50	3	20	3000	100	0
4	20	4	20	1600	100	0
5	20	3	20	1200	100	0
6	20	2	20	800	93	0
7	20	1	20	400	89	0

[0033] when drawer electrode width of face is as narrow as 20 micrometers, so that a drawer number is increased from (Table 1) -- a conductor -- it turns out that the increase of the cross section and the rate of electrical installation increase. the case where a drawer number is three -- the rate of electrical installation -- a conductor -- sufficient connection will be obtained if about 1200 micrometers of cross sections are set to 2. Moreover, when drawer electrode width of face is as wide as 100 micrometers, rate of electrical installation with a drawer number sufficient [at least one] is obtained.

[0034] In addition, by the manufacture approach mentioned above, the multiple-times laminating of the 2nd magnetic-substance green sheet 15 and 2nd conductor 20 is carried out beforehand, without [an imprint and] forming the middle layered product 21, you may sequential-imprint and the 1st magnetic-substance green sheet 12 which imprinted the 1st conductor 18 further as a middle layered product 21 may be stuck by pressure on the top face of the 1st magnetic-substance green sheet 12, although the laminating was carried out.

[0035]

[Effect of the Invention] This invention can offer the manufacture approach of the laminating chip inductor whose electric connection between an end-face electrode and a conductor is hard to generate a crack in a plane of composition even if it carries out the laminating of a magnetic-substance green sheet and the metaled conductor, and improves as mentioned above.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Process drawing showing the manufacture approach of the laminating chip inductor in the gestalt of 1 operation of this invention

[Drawing 2] Drawing showing the cutting location of the drawer electrode and layered product which are this important section

[Drawing 3] Drawing showing the cutting location of the other drawer electrodes and layered product which are this important section

[Drawing 4] The decomposition perspective view showing the structure of the conventional chip form inductor

[Drawing 5] This perspective view

[Description of Notations]

11 1st Base Material

12 1st Magnetic-Substance Green Sheet

13 Through Tube

14 Electrical Conducting Material

15 2nd Magnetic-Substance Green Sheet

16 2nd Base Material

17 Drawer Electrode

18 1st Conductor

19 3rd Base Material
 20 2nd Conductor
 21 Middle Layered Product
 22 Layered Product
 23 Piece of Individual
 24 End-Face Electrode

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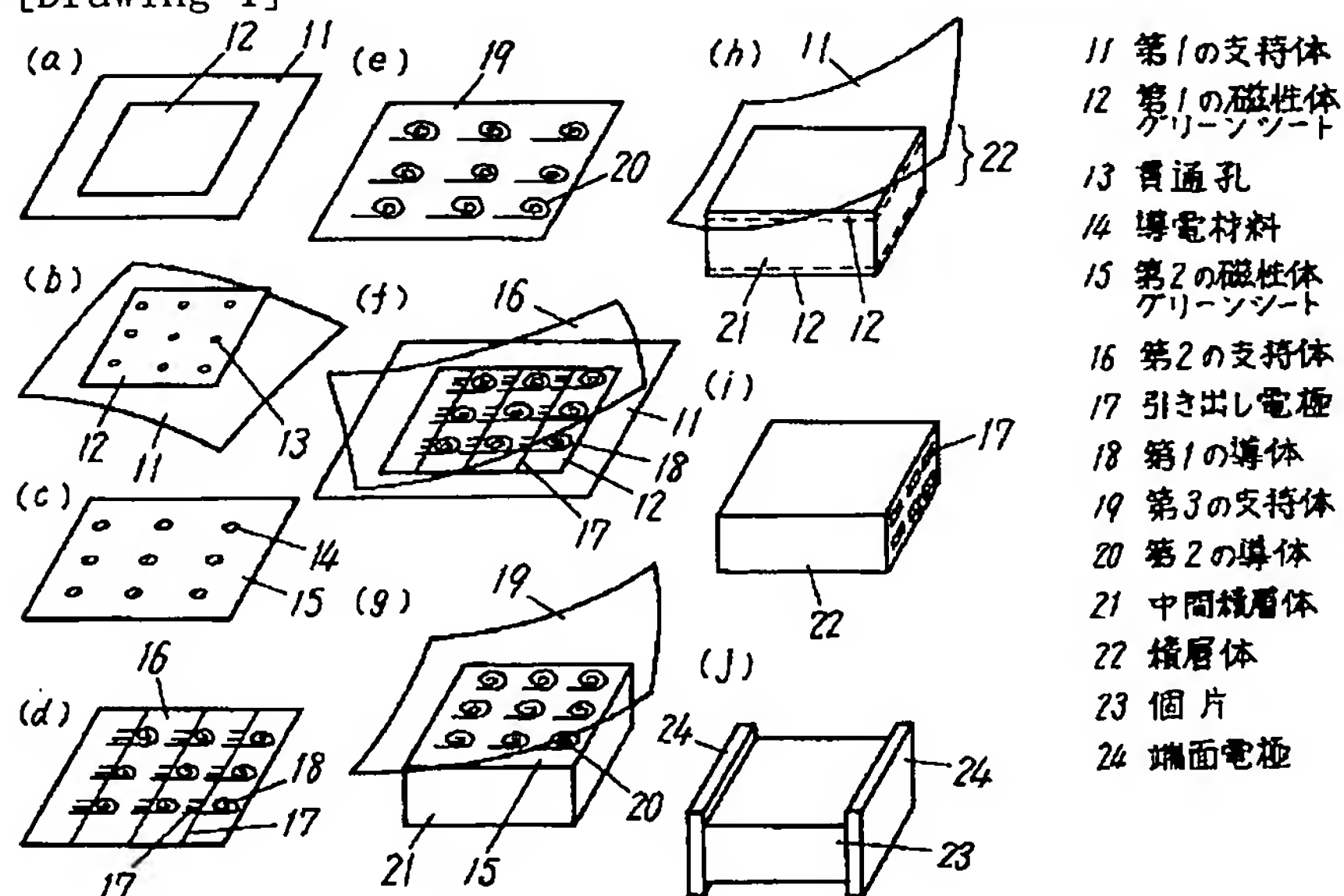
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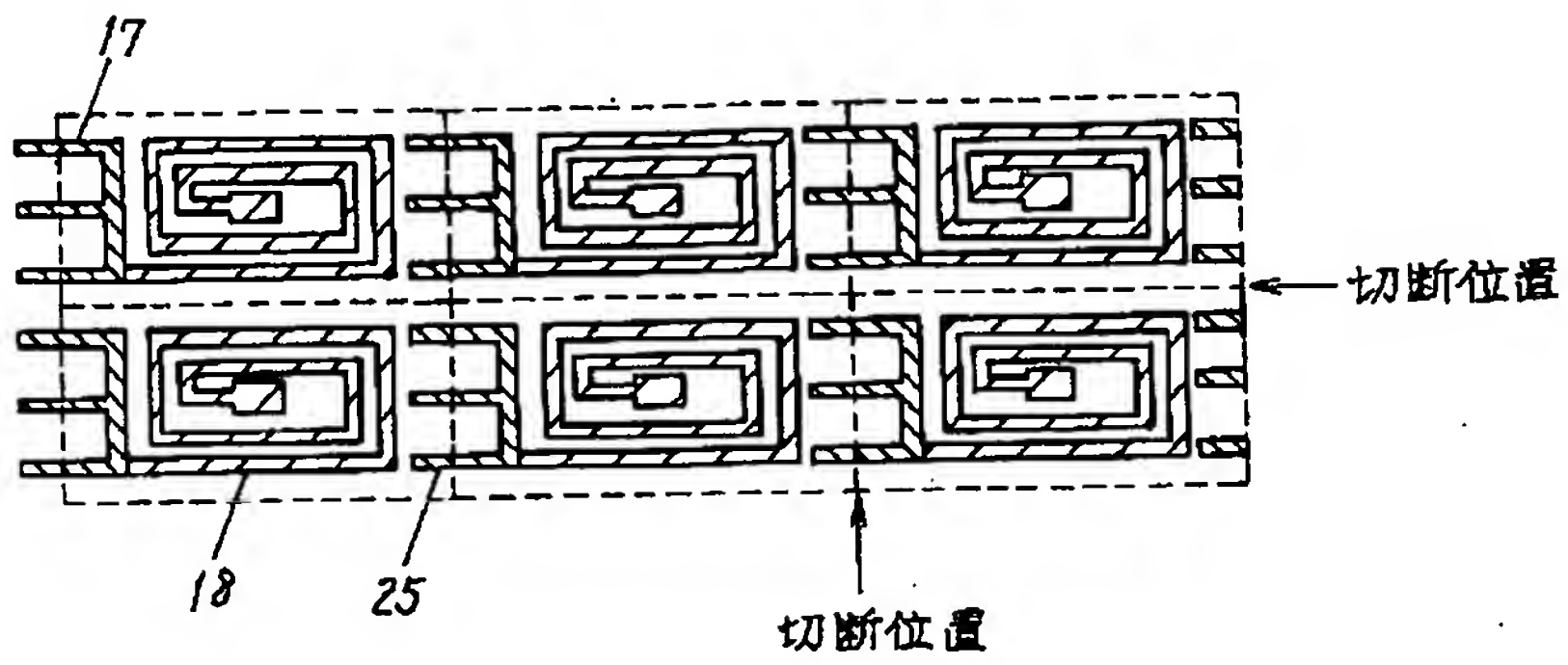
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DRAWINGS

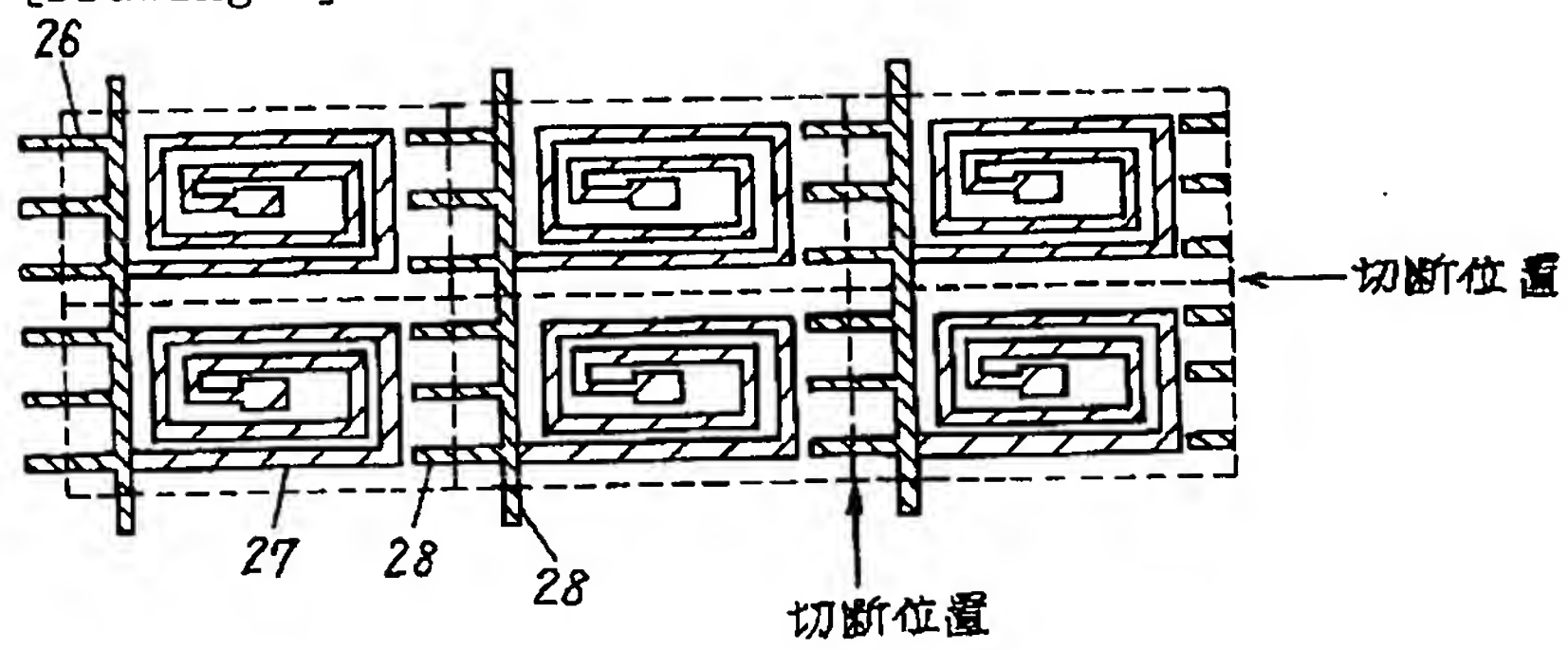
[Drawing 1]



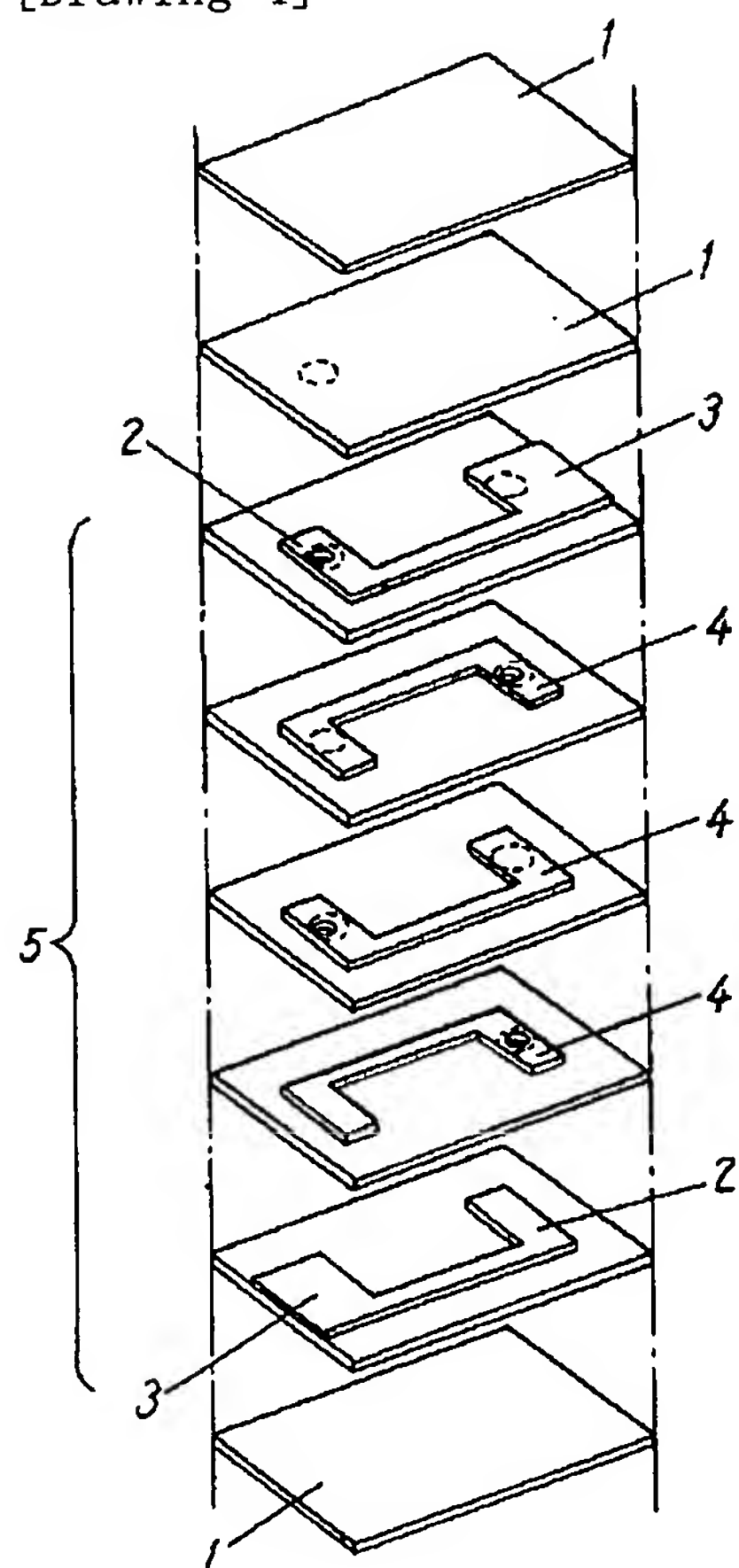
[Drawing 2]



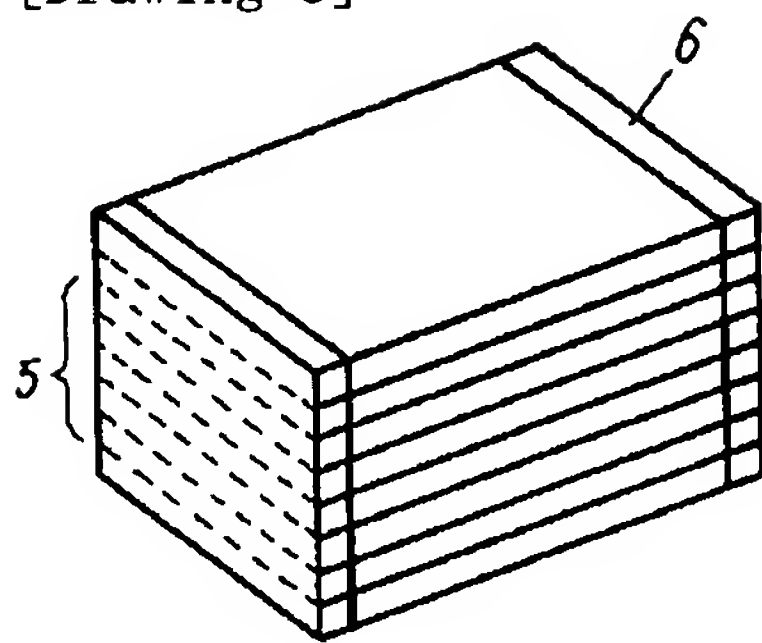
[Drawing 3]



[Drawing 4]



[Drawing 5]



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